MEMORANDUM

TO: Allan Brouillet (MDEQ)

FROM: Dr. Hector Galbraith (Galbraith Environmental Sciences)

DATE: October 23, 2003

SUBJECT: Ecological impacts due to PCDD/PCDF contamination along Tittabawassee River

In a recent email you raised the subject: to what extent can we use the existing data to identify *impacts* to ecological resources in the study area, as distinct from the *risks* identified in the Ecological Risk Assessment.

I believe that we can conclusively identify four different impacts:

1. The soils and the sediments that occur in the ecological habitats in the river and the floodplain are contaminated with dioxins and furans – compounds that are well known from the scientific literature to result in toxicological impacts to exposed wildlife species at very low exposure concentrations. Thus, ecological habitats are contaminated to levels that are likely to result in toxicological impacts to wildlife.

2. At least four species of fish that probably comprise the prey of fish-eating birds and mammals in the Tittabawassee River are contaminated with dioxins and furans to levels that are likely to result in embryotoxic effects.

3. The eggs of wood ducks and hooded mergansers are highly contaminated with dioxins and furans in the study area to levels that are likely to result in embryotoxic effects.

4. Ecological food webs in the study area are contaminated to high levels with dioxins and furans.

Each of the above, in my opinion, comprise impacts to ecological resources.

It is important to realize that, because of their toxicological mode of action, contamination by dioxins and furans is unlikely to result in some categories of impact. For example, these contaminants exert their greatest effects of early life stages of birds and mammals; adult animals are less susceptible. Thus, unlike, for example, some pesticides, high ambient levels of contamination are not usually accompanied by widespread mortality in adult animals. A highly contaminated area will not have corpses strewn across the landscape. The actual effects are much less obvious and more difficult to ascertain in the field: increases in embryo mortality and reductions in fertility or breeding success can only be confirmed after careful and time-consuming study. Even studies of population density might not be sufficient to show impacts: the level of contamination in an area might be sufficient to impair reproduction of sensitive species

(mink, for example), yet animals may still occur in the area as pre-breeders disperse out of uncontaminated population source areas into and through the sink of the contaminated area.

In summary, there is good evidence that some impacts have already occurred to ecological resources in the assessment area. The lack of evidence for others is not evidence that they are not occurring.